REMARKS

This is in response to the Office Action dated March 14, 2006. In view of the foregoing amendments and following representations, reconsideration is respectfully requested.

To facilitate the Examiner's reconsideration of the application, the specification and abstract have been reviewed and revised in order to make a number of minor clarifying and other editorial amendments. Note that the changes to the abstract are submitted in the form of a substitute abstract. Copies of the amended portions of the specification, claims and abstract with changes marked therein are entitled *"Version with Markings to Show Changes Made."*

Further, by the above amendment, claims 1, 4, 7, 11, 12 and 13 are amended; and claims 3, 6 and 10 are cancelled. Thus, claims 1, 2, 4, 5, 7-9 and 11-20 are currently pending in the present application.

Next, in item 1 of the Office Action, the abstract of the disclosure is objected to be cause of the use of legal phraseology. In response, the abstract has been rewritten to avoid the use of the objectionable terms. Accordingly, it is submitted that the abstract is now clearly in compliance with the provisions of MPEP 608.01(b).

Next, in item s3-5 of the Office Action, claims 1-20 are rejected under 35 U.S.C. § 112, second paragraph. In response, claims 1, 4, 8 and 13 have been amended to provide the recitation of a "channel-direction-force component" with proper antecedent

basis. Furthermore, each of the pending claims has been reviewed to ensure that it is in compliance with the requirements of 35 U.S.C. § 112, second paragraph.

Next, in item 7 of the Office Action, claims 1-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Kawai (U.S. Patent No. Re. 33,649). It is submitted that the present invention, as embodied by the amended claims, now clearly distinguishes over the Kawai reference for the following reasons.

In the present invention (as embodied by the pending claims), for the purpose of calculating a stress (a force component) applied in the direction of a flow channel to a valve element by a fluid, the flow regulating valve is provided with a detector that is capable of detecting a force, relative displacement and relative strain between the valve element and a housing that rotatably and axially supports the valve element or a member fixed at least in the flow channel direction relative to the housing (or between a member fixed at least in the flow channel direction relative to the valve element and the housing that rotatably and axially supports the valve element or the member fixed at least in the flow channel direction relative to the housing), thereby detecting the relative displacement etc. of the valve element in the flow channel direction.

According to the present invention, therefore, the flow rate can be acquired with a high degree of sensitivity and a high degree of accuracy. Thus, the apparatus can be made compact, and a stable flow rate value can be obtained, while being less affected by turbulent flow, etc.

Kawai discloses a flow rate regulating butterfly valve including a main body (housing) 1, a valve element 2, and a rotary shaft 3 rotatably supporting the valve element in the main body 1. A strain indicator is provided on the rotary shaft for detecting a dynamic torque applied to the valve member around the valve shaft by the fluid. Note that the dynamic torque, which is generated by the flow of a fluid, is determined from the running torque. The valve disclosed in Kawai is of the type described in the "Background Art" section of the present specification, as originally filed (see pages 1-3).

The detector of the present invention for detecting relative displacement or relative strain etc. of a valve element is neither disclosed nor suggested in the Kawai reference. That is to say, the present invention focuses attention on the relative displacement of the valve element in the flow channel direction, i.e. the displacement of the valve element produced by the flow of a fluid, and since the displacement is directly detected with the detector, the stress of the valve element in the flow channel direction can be obtained with a high degree of accuracy. In contrast, with the Kawai valve, since the running torque includes a torque, etc. resulting from the sliding resistance during rotation of the valve element, the Kawai valve will encounter a serious problem in that the dynamic torque is extremely difficult to purely extract.

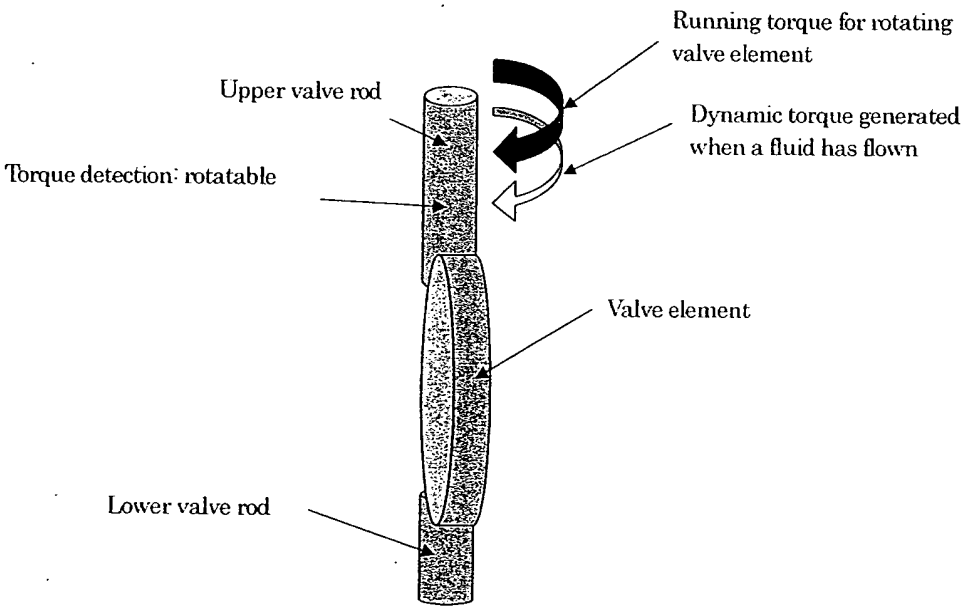
In other words, the present invention has been proposed for the purpose of solving the serious problem (see page 3, lines 1-8 of the present specification) associated with the Kawai valve. The claimed construction enables stress in the

direction of the fluid flow to be obtained with ease and extremely high accuracy, and the flow rate to be calculated with a high degree of sensitivity and accuracy.

As is clear from the above, the present invention differs greatly from the valve disclosed in Kawai, and thus the amended claims are clearly patentable thereover.

Further, in order to clarify the differences between the type of valve disclosed in Kawai and that claimed in the present application, Applicants provide the following detailed explanation.

Measuring System of Kawai



1. Principle of Measurement of Differential Pressure

Flow of a fluid generates a running torque acting to rotate the valve element. The differential pressure is calculated based on the running torque. However, the running torque exerted onto the upper valve rod consists of "a running torque for rotating the valve element" and "a dynamic torque." Of the running torque of the upper valve rod, the dynamic torque alone is used to calculate the differential pressure.

2. Problems Encountered with the Kawai Apparatus

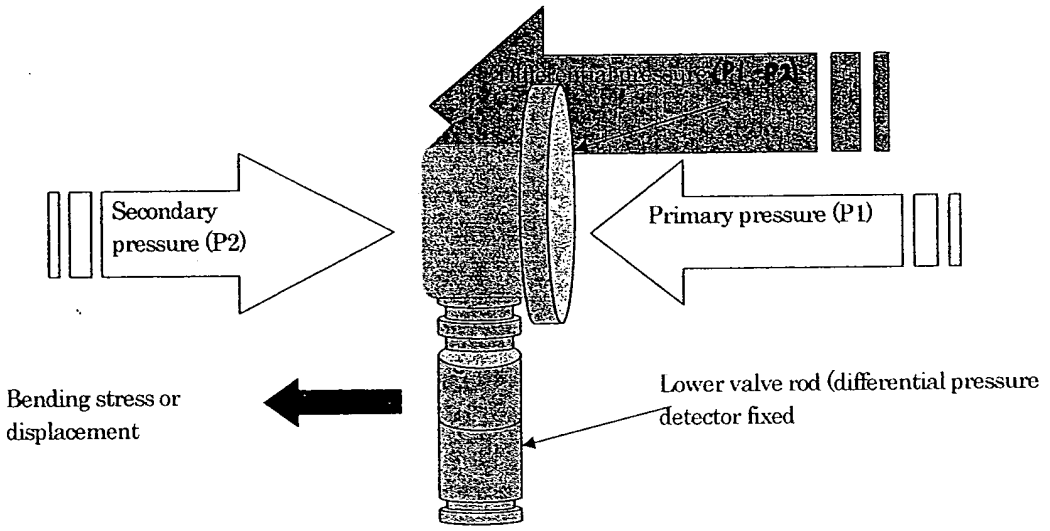
Since the dynamic torque and the running torque for rotating the valve element act in the same direction, it is very difficult to detect only the dynamic torque of the running torque exerted on the upper valve rod. As a result, the detecting method and structure are necessarily complicated.

In order to accurately detect the dynamic torque, it is necessary to eliminate the running torque. In order to eliminate the running torque, a complicated seal structure is required because neither an 0-ring nor a gasket can be used for the seal.

Further, the sensor is installed on a rotating portion of the valve, the necessary electric wiring is complicated and the electric wire portion has to be sealed.

Furthermore, since the dynamic torque becomes extremely low in the vicinity of the positions where the valve element is fully opened and fully closed, it is even further difficult to detect.

Measuring System of Present Invention



1. Principle of Measurement of Differential Pressure:

When a fluid is flowing, a load is exerted on the valve element from a primary side toward a secondary side. As means for detecting the load, the bending stress or displacement of the lower valve rod is detected. Note that this is quite

different from detecting the torque. The differential pressure (load) is calculated based on the detected bending stress or displacement.

While the measurement system of Kawai detects as a running torque the load exerted in the direction in which a fluid is flowing, the present invention can directly detect the load (differential pressure) exerted in the direction in which a fluid is flowing. Therefore, the present invention can provide satisfactory sensitivity and accuracy.

In addition, since the dynamic torque in the Kawai system varies depending on the valve travel, the detecting method and calculating treatment are made rather complicated. On the other hand, in the present invention, since the differential pressure can be detected without relying on the valve travel, the detecting method and calculating treatment are relatively simple.

As is clear from the above, the present invention differs greatly from the Kawai device with regard to the measurement principle employed. Thus, it is submitted that the Kawai reference cannot anticipate any of independent claims 1, 4, and 8 under 35 U.S.C. 102(b) because it clearly does not disclose a stress detecting means for detecting a flow-channel-direction force component of a load applied to the valve element by the fluid, wherein said stress detecting means includes a detector which is able to detect a force, relative displacement or relative strain between said valve element or a member fixed at least in said flow-channel direction with respect to said valve element and said housing which rotatably and axially supports said valve element

or said member fixed at least in the flow-channel direction with respect to the corresponding housing.

Further, with respect to method claim 13, operation of the Kawai valve does not include "simultaneously detecting a flow-channel-direction force component applied to the valve element by the fluid; and obtaining said flow rate on the basis of said valve opening degree and said force component."

Accordingly, since Kawai does not disclose each and every element of claims 1, 4, 8 and 13, it cannot anticipate these claims under 35 U.S.C. 102(b). The remaining claims depend, directly or indirectly, from one of the allowable independent claims, and are thus allowable at least by virtue of their dependencies.

In view of the above, it is submitted that the present application is now clearly in condition for allowance. The Examiner therefore is requested to pass this case to issue.

In the event that the Examiner has any comments or suggestions of a nature necessary to place this case in condition for allowance, then the Examiner is requested to contact Applicant's undersigned attorney by telephone to promptly resolve any remaining matters.

Respectfully submitted,

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ABSTRACT

A flow regulating valve (11) , which has a valve disk (11b) operably disposed in a flow channel and is capable of regulating the flow of fluid according to the valve opening degree of the valve disk ~~(11b), is characterized by comprising~~ (11b). The valve includes a stress detecting ~~means~~ device (13) for detecting the flow-channel-direction force component of a load applied to the valve disk by the fluid, and a valve opening degree detecting ~~means~~ device (12) for detecting the degree of opening of the valve disk. ~~The~~ A flow rate calculating ~~means~~ device (14) finds the flow rate (Qm) from the stress ~~(fm)~~ obtained from the stress detecting ~~means~~ device and from the valve opening degree ~~(θm)~~ obtained from the valve opening degree detecting ~~means~~ device. A ~~control~~ controller means (15) controls a valve disk driving ~~means~~ device (18) on the basis of the flow rate to drive the valve disk for opening and closing. ~~This makes it possible to find the flow rate with higher sensitivity and accuracy than in the prior art, the construction being compact and simple, providing stabilized data.~~

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